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AVIONICS PLANNING GUIDANCE. EXECUTIVE SUMMARY.(U)

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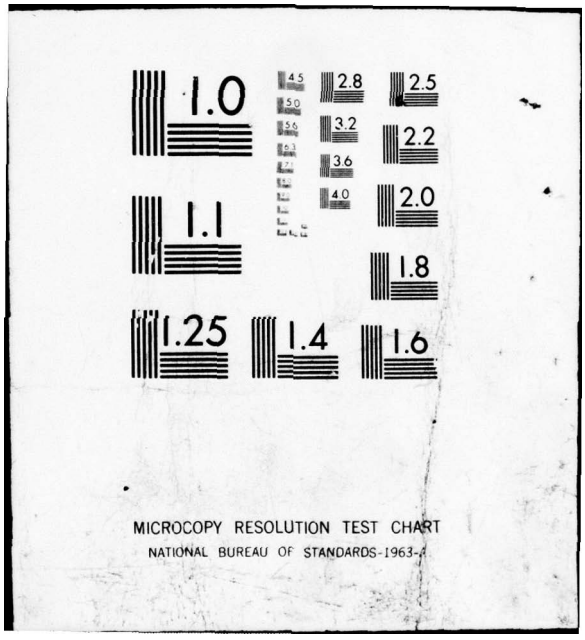
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EXECUTIVE SUMMARY

AVIONICS PLANNING GUIDANCE.

Executive Summary.

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Presents guidance for the development, acquisition and support of Air Force avionics systems for the period FY 1978 through FY 1981. Relates threat and mission area analysis results to an avionics investment and support strategy.

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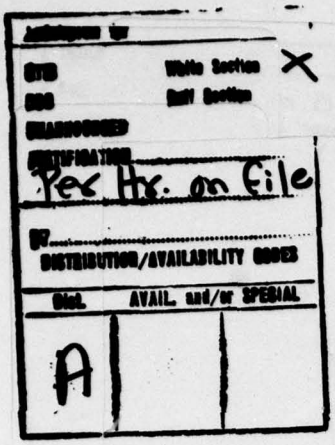

FOREWORD

This document provides the basis for a consolidated Air Force investment strategy for avionics system development and support. The strategy was drawn up during a technical forum held in January 1978 attended by key representatives of Air Force development, logistics, and using commands. A broad series of technical and policy initiatives is outlined to complement the findings of the forum. Additional detail and rationale associated with the initiatives are contained in proceedings issued separately.

This document was compiled from the above proceedings and from other Air Force source materials by ARINC Research Corporation under Contract F04606-76-A-0087/SG01. Additional technical assistance was provided during the deliberative process by representatives from the RAND Corporation, the MITRE Corporation, Analytic Services, Inc. (ANSER), The Analytic Sciences Corporation (TASC), and the Airlines Electronic Engineering Committee (AEEC).

The limitations of time and resources available in preparing this initial document should be acknowledged. It is the intent of the Air Force to refine and expand the material presented here in successive annual iterations to produce an avionics investment and support strategy that addresses all aspects of the technical, management, and operational factors.

CONTENTS

EXECUTIVE SUMMARY

AVIONICS PLANNING GUIDANCE

1. PURPOSE

The purpose of this document is to provide current guidance and specific policy interpretation regarding USAF avionics system development and support. This guidance should be used in preparing program submissions for HQ USAF consideration in the FY 81-85 Program Objective Memorandum (POM) exercise. This document will be updated annually for succeeding POM exercises to reflect changes in emphasis resulting from OSD direction, threat developments, or similar considerations.

2. SCOPE

This guidance applies to all aspects of the avionics planning and support process: technical, managerial, and operational; however, material developed in this document does not circumvent existing regulations, directives, and direction procedures. The concept embodied in this document and its implementing regulation AFR 800-28 (draft) is to assure that the avionics policy and programs receive, during their formulation stage, exposure to and contributions from affected sectors of the defense community and industry. This exposure is developed primarily through participation in the Annual USAF Avionics Planning Conference, and on an individual system basis through the operational requirements process delineated in AFR 57-1.

3. ORGANIZATION AND INTERPRETATION OF GUIDANCE

The Avionics Planning Guidance document is organized into four major sections:

- The Introduction establishes operative definitions and the regulatory framework through which implementation will be achieved.
- An Operational Factors section reviews current intelligence of interest to the avionics community and provides interpretation of current mission area analyses and their correlation to avionics functional areas.

- A Technology Factors section describes pertinent technology and current equipment developments that are considered key to meeting the operational challenge.
- An Avionics Investment and Support Strategy section introduces major new initiatives to overcome remaining technical or policy deficiencies.

An important concept to be considered in the review of this document is that the proposals discussed here represent only a part of the overall investment strategy for the Air Force. Other (non-avionics) solutions, such as additional training and personnel, will be proposed to meet Air Force's future requirements. These proposals will be considered together in the POM exercise to arrive at a balanced approach that recognizes practical resource limitations. The avionics initiatives described in this document represent a set of alternatives for use in the POM decision process.

It is also important to recognize that a rigorous order of priorities cannot be assigned to the various elements of the proposed investment and support strategy. The programs and policy initiatives described in this document are all of critical importance and should receive close attention at all levels of command. The assessment of the relative importance of one program to another must be made subjectively in a process that implicitly considers the importance of each mission assigned to the Air Force. This is the function of the Air Staff POM exercise.

4. SUMMARY OF FINDINGS

The findings may be divided into five major categories corresponding to the form of improvement each action would make to the Air Force:

- Combat effectiveness
- Survivability
- Availability
- Standardization
- Management

A road map of major activity proposed for each of these topics is described in Sections 4.1 through 4.5.

4.1 Combat Effectiveness

Combat effectiveness was examined in four functional areas: target acquisition; positioning/navigation; command, control and communications; and fire/flight control. An additional area of paramount concern spanning all four areas related to controls and displays technology. A fundamental

conceptual problem that spanned all of the functional areas of the tactical mission was the lack of a comprehensive model of the tactical battlefield. Many of the issues centered around tradeoffs between alternate concepts: autonomous versus cooperative strike, low-altitude versus medium-altitude operations, precision navigation versus better sensors, and so forth. Thus, there is a need for the community to continue studies, analyses, and development of analytic tools precise enough to be useful in making avionic acquisition decisions.

This section summarizes the actions required to enhance combat effectiveness and defines existing interrelationships. The road maps are laid out in general terms from now through FY 85. The times for accomplishment of the various tasks are approximate; it is the sequential relationship of the tasks that is to be conveyed here. Detailed milestones for the activities are to be defined in further dialogue among the agencies affected.

4.1.1 Understanding the Battlefield

Key actions under the general grouping "Understanding the Battlefield," are presented in Figure 1. The initial action is for AF/RD with AF/SA to review recent and current studies to determine their relevance to questions raised during this year's planning activity. If necessary, current study activity should be redirected to provide insight into the vulnerability of standoff/cooperative systems for the next planning conference, scheduled for November, 1978.

The broader questions will require more substantial analysis. The November, 1978, planning conference should provide the general study guidelines, but the office of the Deputy for Avionics Control (DAC) and other affected organizations should anticipate the nature of the issues raised and assure that the necessary evaluation tools and data are available to begin this task. The need to further expand the precision autonomous navigation technical base (particularly INS) should also be addressed in November, 1978, after the vulnerability of standoff/cooperative systems is better understood.

Sufficient rationale exists now to begin the investigation of approaches for single-seat aircraft Terrain Following/Terrain Avoidance (TF/TA). A production decision will not be made until the requirements have been thoroughly studied and a technical assessment has been made for the impact on the potential airframes.

Key development decisions must be made in the FY 82 to FY 83 time frame. The preceding activity, as well as other technical base development, will provide the basis for these decisions. The goal to be sought by the mid-1980s is operational flexibility. This operational flexibility will be obtained through assuring a balanced mix of autonomous and cooperative systems and a force capability to operate at all altitudes in all weather, to the extent economically practicable.

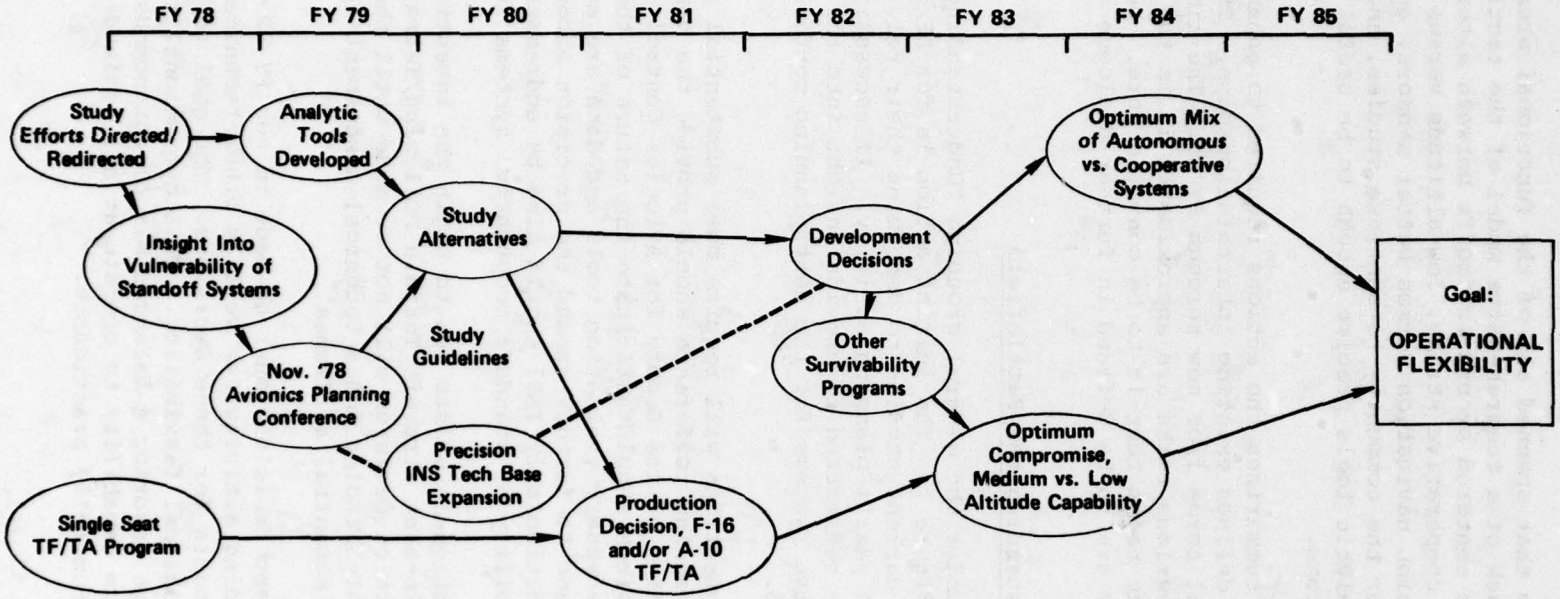

Figure 1. ROAD MAP: UNDERSTANDING THE BATTLEFIELD

4.1.2 Integrated Avionics Architecture

Actions under this grouping have been divided broadly into ASD initiatives and laboratory initiatives in Figure 2. The shared responsibilities for the DAIS program determine its location in both areas.

Much of the activity required to achieve the joint goals of reduced operator workload and survivable critical systems has begun or is currently planned. The principal requirement is for a coordinated overview to eliminate unnecessary redundancy and assure harmony of results. This role should be adopted by the Deputy for Avionics Control (DAC) office when it is established.* The desirability of a separate ASD Controls and Display (C/D) program office should be assessed by the DAC as early as possible.

Major funding decisions revolve about the requirements for this C/D program office, the automatic target screening program, and the allocation of 6.2 and 6.3 monies among the various laboratory programs.

4.2 Survivability

A force-wide emphasis on avionics that adequately addresses survivability is required. This implies a merging of the world of avionics activities (including electronic warfare) as well as the designation of an Air Force avionics focal point such as the proposed Deputy for Avionics Control. In addition, increased management recognition and acceptance of the need for electromagnetic hardening (nuclear and non-nuclear) in the various mission areas (especially tactical) is required.

The overall activity road map for survivability is represented in Figure 3. The close interrelationship with combat effectiveness activities is recognized by the actions shown outside the dashed line.

The office of the Deputy for Avionics Control plays a central role in these activities. When it is established, the DAC should publish memorandums of agreement (MOA) with principal AFSC and AFLC organizations having responsibilities in the EW area, for example, ASD/AEW, AFAL/RW, and WRALC. Two major activities should be initiated: (1) the formulation of survivability design guidelines for avionics subsystems (which should be consistent with the overall architectural concepts defined in Section 4.1.2), and (2) the formulation of an avionics "Red Team" to assure that these guidelines and other avionics developments consider the changing threat environment as perceived by all commands. Initially, this team should employ existing in-house resources and contractual resources; eventually, a full-up simulation facility will be required to examine the effectiveness of proposed survivability modification programs.

A far-term objective is to establish a survivability plan early in the design stage of each new aircraft. This plan should also receive scrutiny from the simulation activity and would be subject to change as new threat information is obtained.

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*See Appendix A for charter, effective 1 May 1978.

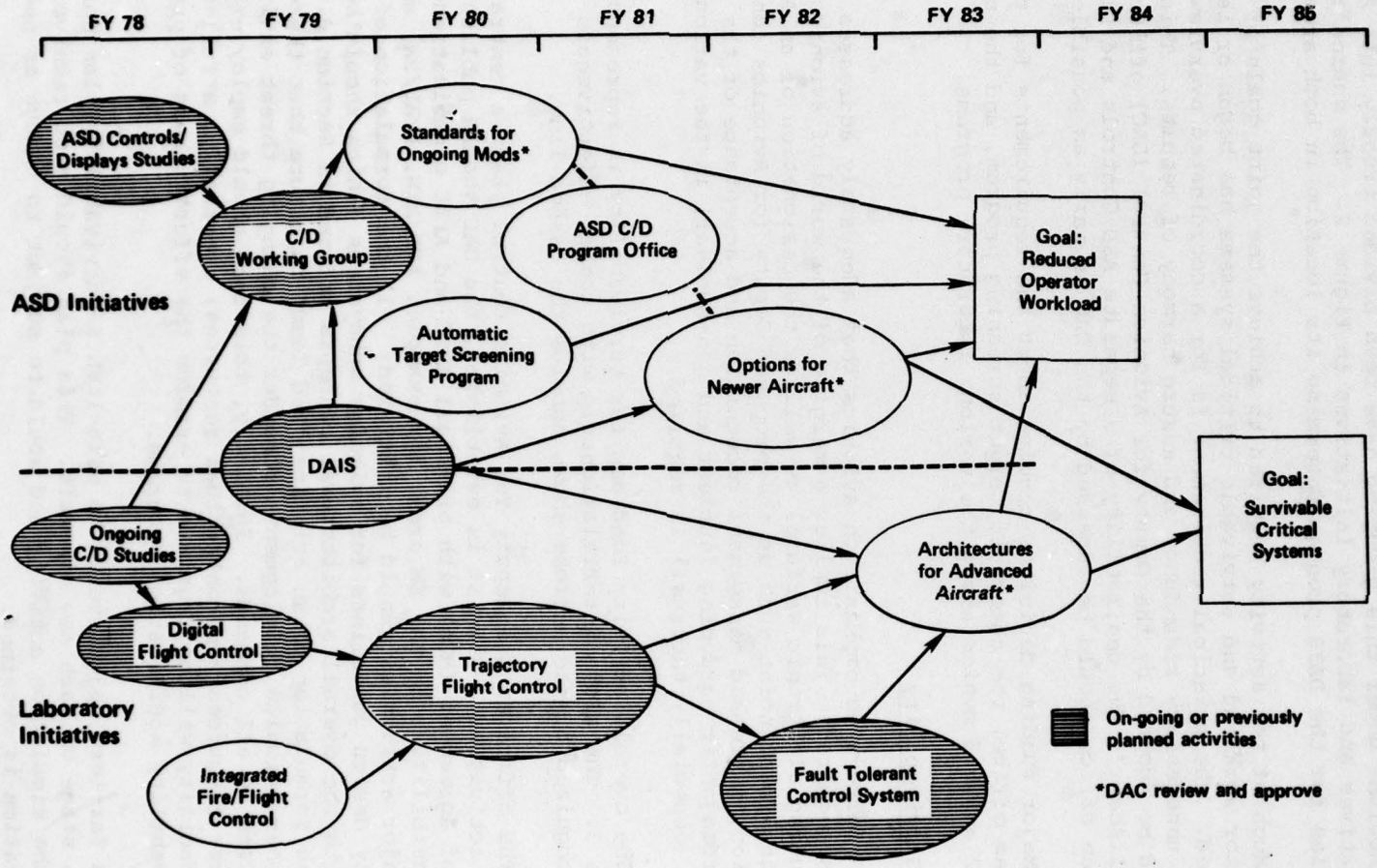

Figure 2. ROAD MAP: INTEGRATED AVIONICS ARCHITECTURE

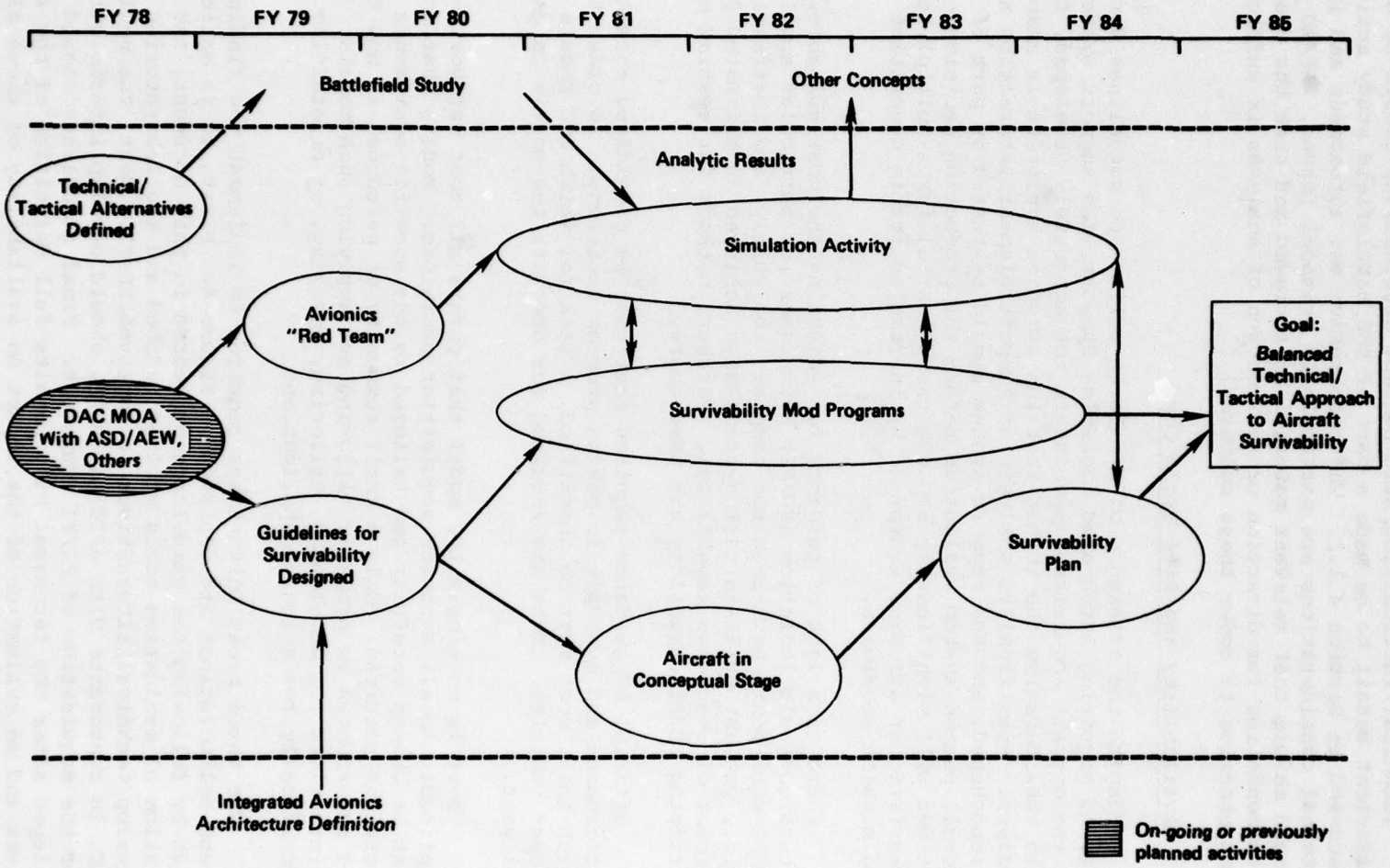

Figure 3. SURVIVABILITY ROAD MAP

Technical/tactical/logistic concept alternatives should be defined in sufficient detail to be made a part of the battlefield study activity, discussed in Section 4.1.1. The cooperative vs. autonomous and internal vs. external considerations are particularly critical issues. AF/RD and AF/SA should ensure that relevant material is reviewed and that the resulting recommendation for direction or redirection of analyses is sufficiently comprehensive to cover these concerns.

4.3 Availability and Life Cycle Cost

Despite the existence of Air Force policy and guidelines for developing and acquiring Integrated Logistics Support, the support system as part of the overall acquisition process is not adequately developed, fully taking into consideration the threat that the avionics equipment is meant to address. Specifically, analysis of support element interaction needs to be strengthened, and the support system should be tested as part of the overall weapon system evaluation before the production decision. These actions will significantly improve the potential force-multiplying characteristic of avionics equipment by increasing sortie generation capability and mission readiness.

There is a lack of guidance for selecting the most suitable Fault Detection/Fault Isolation (FD/FI) techniques for particular applications. FD/FI equipments have been too complex, too costly, and ineffective (e.g., present built-in test systems have achieved an estimated 20-85 percent of specified capability). Further, methods for testing or verifying FD/FI capability are inadequate.

Official AF guidance requires that cost be considered equally with performance and schedule in making program decisions. In order to accomplish this, cost must be quantified, a task for which LCC models are the proper vehicles. Data are required for use with the models in making LCC analyses.

There is no single LCC model that covers all cost categories and is applicable to all avionics acquisition decisions. Models that do exist must be chosen carefully and tailored to the specific equipments and decisions required. Only a small community of personnel is now trained and experienced in properly tailoring and applying such models. No focal point exists for developing, tailoring, applying, or maintaining models specifically for avionics applications.

The three broad initiatives required to implement the findings of these deliberations are depicted in Figure 4. First, it is anticipated that by following the guidelines suggested in this document, the proliferation of evaluation tools will be reduced and the laboratories will develop technical alternatives to improved FD/FI. Next, the newly formed DAC, in consonance with AFSC and AFLC, should develop interim guidelines for the acquisition of FD/FI equipment. Final guidelines should be developed after the technical base permits full definition of the alternatives and an evaluation of the impact on availability of these alternatives.

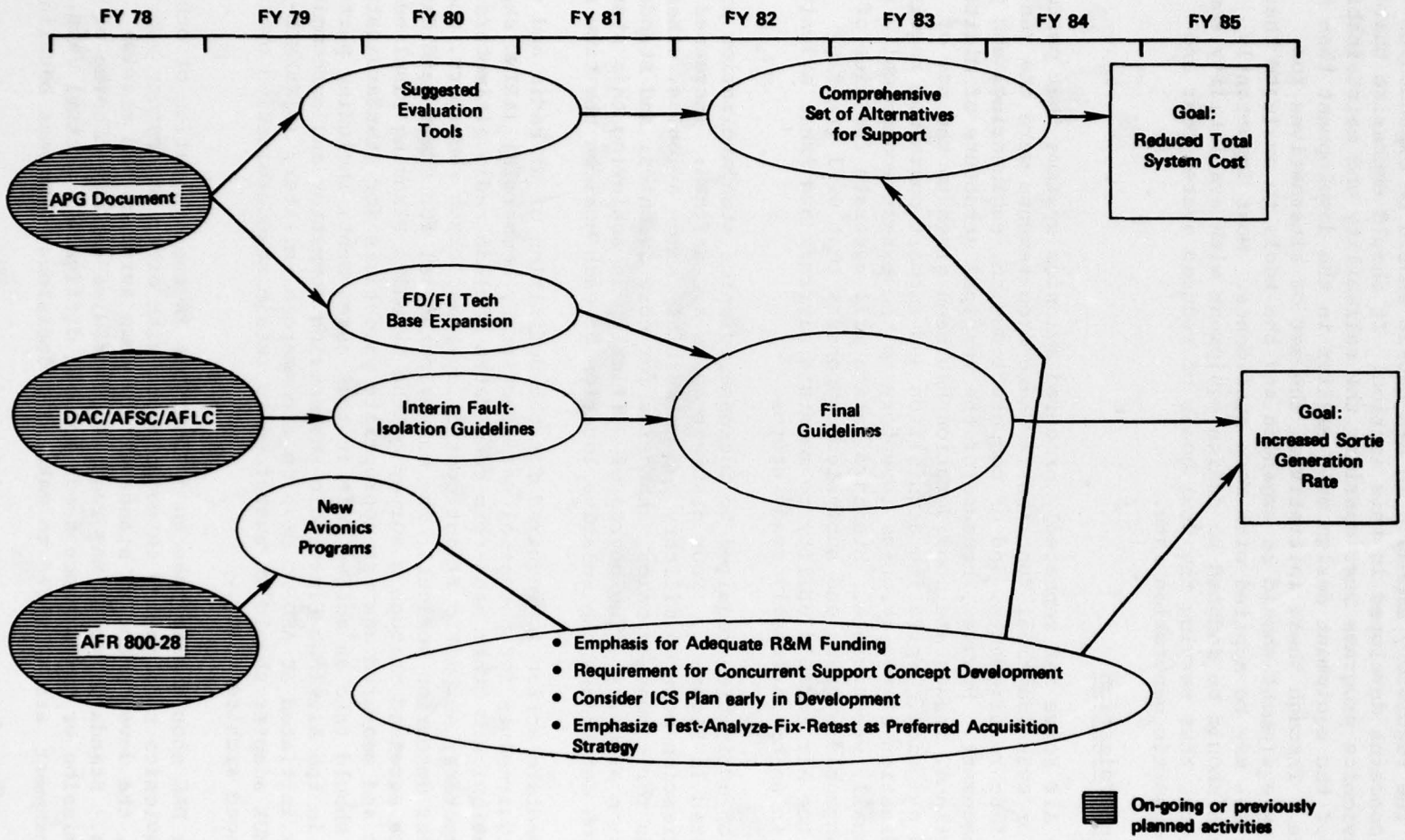

Figure 4. AVAILABILITY AND LCC ROAD MAP

Finally, the regulatory emphasis in AFR-800-28 should be expanded to include concerns developed in this section. It should emphasize that future avionics programs must consider the reliability and maintainability aspects of the equipment design much earlier in the development than has been done. Through these initiatives, the set of alternatives for supporting equipment should be expanded and the tools to evaluate these alternatives may be applied with more confidence. Most importantly, developers should be induced to design equipment with availability considerations, thus serving the dual goals of reduced system cost and increased sortie generation rate.

4.4 Standardization

The Air Force has repeatedly procured avionics systems that perform similar or even identical functions. These procurements were the result of bona fide requirements, and of competent design, engineering, and program management. However, because of the vertical structure of military organizations, inadequate consideration has been given to the use of standard avionics. Spiraling acquisition and support costs now require standardization of the avionics inventory to the extent economically and operationally practicable. Standardization will generate families of interchangeable systems and subsystem components that will greatly enhance the Air Force's ability to maintain aircraft and their avionics systems in an operationally ready status.

Major activities required to increase avionics standardization are represented in Figure 5. Four distinct goals are defined: increased standardization between military and commercial common avionics, other standards for common avionics, standards for core avionics, and standards for mission avionics. The degree of difficulty in achieving this standardization determines the relative location of each goal on the time scale.

Immediate action is required for the definition of HF radio and weather radar requirements for potential satisfaction by commercial (ARINC characteristic) avionics. Other near-term candidates include radio altimeters, air data computers, automatic flight control systems, crash recorders, and wind shear detection devices. The market potential for these candidates should be assessed through a survey of the Avionics Planning Baseline document and measured against appropriate yardsticks for standardization. The DAC should take an active role in this assessment, including participation in the Airlines Electronic Engineering Committee and subcommittees. Activity initiated at ASD to develop a commercial-military (DITS/MIL-STD-1553A) MUX adapter should be sustained to retain standardization options in advanced architectures.

The DAC should also take an active role in the evaluation of other common avionics candidates, in cooperation with other laboratory and ASD efforts, the development of standards for core avionics and mission avionics. Standardization may require compromise--and compromise of perceived mission or performance needs is most difficult. Factual data and sound judgment are required to make hard decisions. Current baseline data

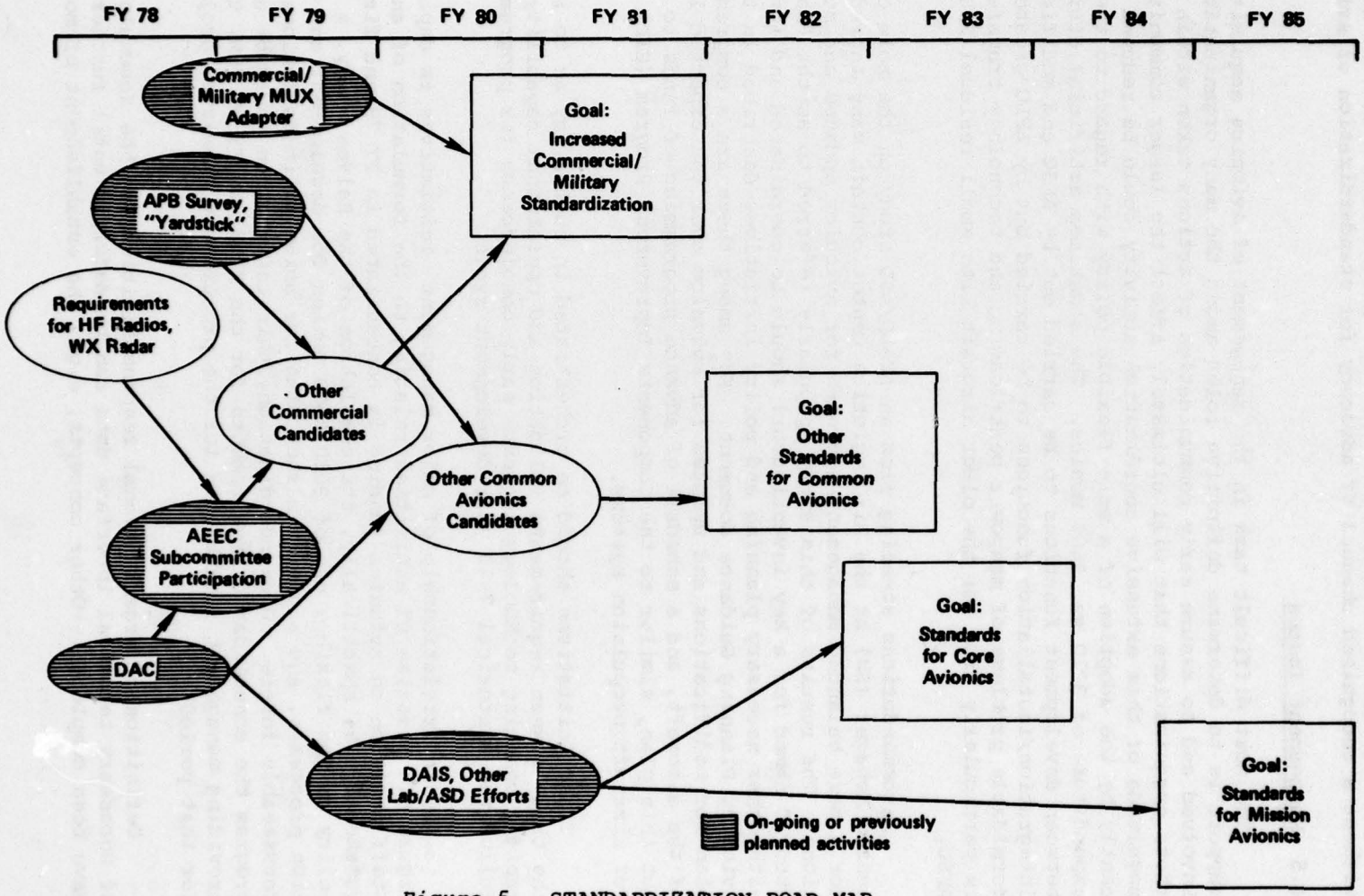

Figure 5. STANDARDIZATION ROAD MAP

must be improved and new sources developed to provide the decision basis. Front money for standardization is a major problem and cannot be resolved without a recognized channel of advocacy for standardization of avionics.

4.5 Management Issues

The most difficult task in the management of avionics acquisition and support is to determine definitive roles among the many organizations involved and to assure early communication of actions taken within each of those organizations that will ultimately affect the larger community. The magnitude of this extensive coordinative activity could be reduced significantly by the adoption of a more flexible policy with regard to the expenditure of 3010 vs. 3600 monies. The sometimes artificial division between development functions to be carried out by AFSC and modification/integration/installation functions to be carried out by AFLC creates formidable problems of manpower peak-loading and technology transfer. This is particularly true for the older aircraft with small residual SPOs within AFSC.

Recommendations stemming from an AFALD/ASD study on the role of the System Manager (SM) at the Air Logistics Center contain many ingredients for a more balanced management approach for avionics updates and modifications. The results of this study (popularly referred to as the "Balven Study," named for a key investigator) should be coordinated and integrated with other necessary planning and policy initiatives described in the basic Avionics Planning Guidance document. Key among these are a comprehensive plan for modifications and updates for avionics over the expected lifetime of the aircraft, and a schedule of advance programming of funds to carry out this plan, similar to the Components Improvement Program (CIP) employed for aircraft propulsion systems.

These initiatives should be orchestrated in such a way as to reduce the time between requirements validation and operational capability. The rapidly changing technology suggests early obsolescence for programs that follow the historical 7-12 year development cycle.

The interrelationship of major management initiatives is depicted in Figure 6. A series of activities relating to the formulation of an Air Staff position on avionics funding is concentrated in FY 78 and first quarter FY 79; specifically, the completion of the Balven study, a draft policy on the flexible use of 3010/3600 monies for development and modification processes, and a master market plan for avionics installations in the foreseeable future. Upon coordination, this information could be used to program the consolidated requirements for the FY-81 to FY-85 POM, thus providing management flexibility for the procurement "bowwave" projected for that period.

Definition of organizational responsibilities and the accumulation of necessary technical interface data can be deferred until further studies have been completed. Other concepts, e.g., the establishment of modification

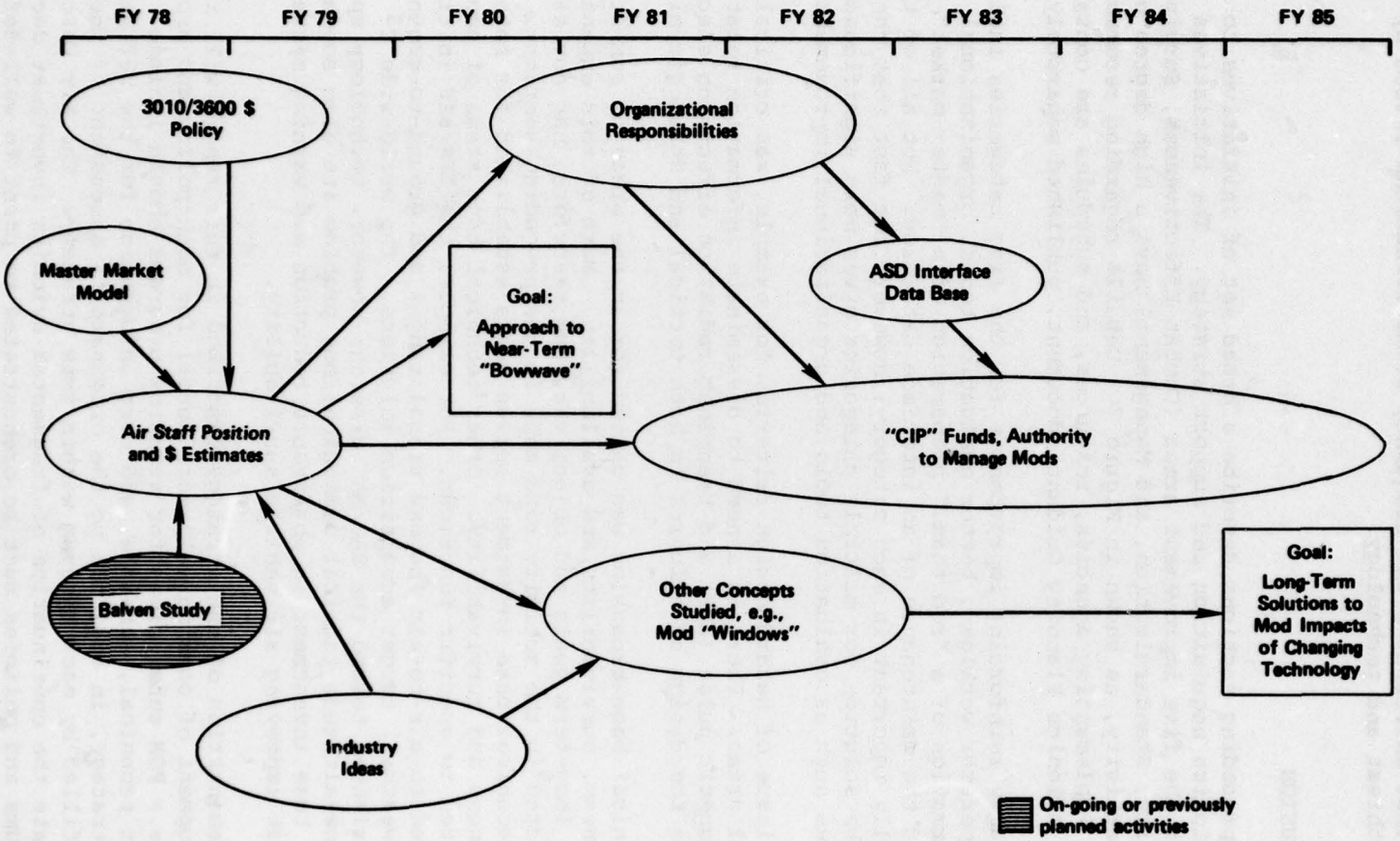

Figure 6. MANAGEMENT ROAD MAP

"windows" for each aircraft, should also be subjected to more scrutiny. The long-term goal is to establish a technical, organizational, and business approach that anticipates the frequency of modifications forced by the changing threat and technology.

5. CONCLUSION

The preceding sections describe a broad set of initiatives to establish a USAF avionics acquisition and support strategy. The initiatives recommended for the five improvement areas (Combat Effectiveness, Survivability, Availability, Standardization, and Management) have a high degree of interconnectivity, as shown in Figure 7. Details regarding recommended programs, implementing agencies, resources, and schedules are contained in the basic Avionics Planning Guidance document, published separately.

Mutually reinforcing improvements for the five categories include reduced operator workload, better evaluation tools, organizational adjustments, formation of a "red team," preparation of a "master market" plan/model, and the maintenance of an interface data base. Not all of these were equally important in each category; however, the fact that they are a part of the solution for multiple categories gives more significance to initiatives such as evaluation tools and organizational improvements.

The issue of hazard design criteria, for example, was critical in most functional areas. There is a need to disseminate information relative to electromagnetic pulse (EMP) and transient radiation effects on electronics (TREE) for the design of avionics in both tactical and strategic missions.

Technical base expansion was called for in the areas of combat effectiveness, survivability, and availability. Much of this expansion points to long-term goals and objectives, and therefore, has not always been depicted in the activity road maps in the preceding sections. The ECM/OCM technical base investment serves goals established for both combat effectiveness and survivability. Other technical base areas of emphasis are oriented to specific functions. For example, the IFF/SIF initiative is oriented to air-to-air (beyond visual range) and ground-to-ground (adverse weather) target acquisition solutions. The world-wide C^3 initiative is oriented toward the SAC/MAC mission; however, technology spin-offs for the low-altitude tactical communications problem are also sought. Technical base investment in observable reduction and warning systems is directed at improving air vehicle survivability.

Implementation of the strategy described in this report will require the development of considerably more detail for each policy and program initiative. POM submissions for avionics programs should include sufficient technical, schedule, and cost information for the refinement of this strategy, in addition to the originator's assessment of the role or roles filled by each program within this strategy. The Air Force cannot tolerate the continuation of fragmented avionics investment decisions. Our programs and policies must be orchestrated to point to well-defined goals and obligations within assigned missions.

Improvement Areas	Improvements				
	Combat Effectiveness	Survivability	Availability/ LCC	Standardization	Management
Pilot Workload	X	X			
Evaluation Tools	X	X	X	X	
Harden Design Criteria	X	X		X	
Organizational		X	X	X	X
"Red Team"		X			X
Market Model				X	X
Interface Data Base	X			X	X
Tech Base Investment					
IFF/SIF	X				
ECM/OCM	X	X			
Observable Reduction		X			
Warning Systems		X			
Fault Isolation			X		
C^3	X				

Figure 7. SUMMARY OF MAJOR INITIATIVES

APPENDIX A

CHARTER
Deputy for Avionics Control

This charter outlines the scope, purpose, objectives and responsibilities of the Deputy for Avionics Control as established jointly by the Commander of Aeronautical Systems Division, Air Force Systems Command and the Commander of Air Force Acquisition Logistics Division, Air Force Logistics Command.

SCOPE - The Deputy for Avionics Control will consider all aspects of avionics and related support equipment which are to be used with Aeronautical Weapon Systems throughout the life cycle of the system. It will participate in the development, support, and policing of avionics strategy as well as the activities of those organizations assigned the specific responsibilities involving technology, development, acquisition, modifications, logistics support and definition of requirements. Avionics comprise the electronic and electromechanical systems or subsystems (hardware and software) installed in or attached to an aircraft, to include related support equipment.

PURPOSE - The Deputy for Avionics Control will provide a focal point to coordinate the planning, development, acquisition, maintenance and modification of all avionics under an Air Force wide master plan. It will also provide a mechanism whereby the issues and tradeoffs associated with avionics systems engineering, digital architecture, and avionics standards may be resolved prior to application in any weapon system.

OBJECTIVES - The Deputy for Avionics Control has the primary objective that avionics for USAF weapon systems are cost effective, reliable, and have sufficient performance to achieve required mission objectives. Maximum emphasis will be placed on improving the avionics contribution to sortie generation rate and the reduction of USAF costs associated with avionics. The Deputy for Avionics Control will strive to achieve force-wide definition, development, and application of avionics standards, standard equipment and software and standard avionics system architecture, such that unnecessary duplicative developments are avoided, proliferation of support equipment is minimized and that the use of reliable, modular, upward compatible avionics design concepts and equipment are promoted.

RESPONSIBILITIES - The Deputy for Avionics Control will:

a. Develop a coordinated Air Force Avionics Master Plan, secure its approval, implement its use, monitor and report its progress.

b. Review, approve, guide, and assist all AFSC and AFLC avionics development, engineering, procurement, and support activities in pursuit of the USAF Avionics Master Plan objectives.

c. Develop and maintain an Air Force Avionics Data Base on all current and planned avionics programs, equipments, and standards. In addition to status and programming information, this data base will include data on system/subsystem cost, reliability, performance, and interfaces.

d. Implement a mandatory review and coordination process for all requirements, program definition, program justification, and procurement documentation for all 6.3, 6.4, and production avionics new starts, modifications, or changes to existing avionics programs.

e. Task other organizations in the conduct of the Deputy for Avionics Control mission.

f. Conduct periodic review and mandatory coordination at the major program milestones and such other times as directed.

g. Work in concert with ASD Program Offices, AFALD, AFWAL Laboratories and other organizations to provide assistance in the formative stages of avionics related programs.

h. Identify and guide promising initiatives involving new technology, application of standard architectures and opportunities for common and/or standard application of equipment.

i. Assist in the development of an Avionics Investment Strategy and recommend to AFSC, AFLC, and HQ USAF, through appropriate command channels, those areas which require funding and development to achieve the overall objectives outlined in the Avionics Master Plan.

DEPUTY FOR AVIONICS ESTABLISHMENT PLAN

APPROACH:

Phased, evolutionary growth over next 18 months

OBJECTIVE:

Achieve USAF avionics control function operating IAW approved charter

- Establish USAF single manager of avionics for all matters relating to development, procurement, and support
- Generate USAF avionics master plan and implement
- Implement USAF organic systems engineering capability

GROWTH PLAN: 3 Phases

NOW: Establish baseline control function - 30 people

01
- Leadership/admin
- Technical Cadre
- Management interface cadre - SPO/ALC programs
- Data base generation cadre

NOW + 6-12 months: Expand functions - 50 people total

02
- Augment existing cadres according to workload
- Test and evaluate cadre added
- Rel. and maint. cadre added
- Establish command/product division committees

NOW + 12-18 months: Expand functions - 80 people total

03
- Augment existing cadres according to workload
- Cost analysis/LCC group formed
- Reorganize to consolidate functions

Phased Workload Plan

01
- Establish organization
- Negotiate MOU/MOA with interfacing organizations
- Establish structure of avionics master plan
- Orchestrate DAIS transition plan/ASD implementation
- Interact with F-111 A/E/D/F/FB, B-52 D/G/H avionics update
- Start work on computer based avionics data base management and management information systems
- Initiate major studies
- Generate budget
- Establish procurement document review procedures
- Report progress - AFSC/AFLC/Air Staff/SAF

02
- Carry on/complete 01 tasks
- Establish T&E function - AFTEC interface
- Establish R&M function - cert eval/implementation
- Establish command-wide working groups/committees
- Start work on avionics support facilities (AFLC) correlated with avionics development facilities (ASD)
- Participate in AFSC avionics investment strategy
- Complete/coordinate avionics master plan
- Interact with new aircraft avionics programs

03
- Carry on/complete 0/1/2 tasks
- Establish cost analysis/LCC function
- Reorganize to consolidate functions for improved management and reduced management overhead
- Implement avionics master plan